

Implant-Assisted Removable Partial Denture in Long Class IV Kennedy: a Biomechanical Strategy

Prótese Parcial Removível Implanto-Assistida em Classe IV de Kennedy Ampla: uma Estratégia Biomecânica

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Abstract

Removable partial dentures (RPDs) are an indication for Kennedy Class IV planification. However, in long edentulous space, it becomes a biomechanical challenge, since it results in an anterior free end, in turn, and in lever movements. Such conditions can create a greater probability of bone loss, torque on abutment teeth and instability of the denture. In this sense, strategies to improve the biomechanical performance of RPDs are essential in planning. The objective of this clinical case is to report the prosthetic rehabilitation of a partially edentulous patient, IV Kennedy classification, with implant-assisted RPD. Patient was complaining that her RPD in the upper arch was unstable and, among the treatment plan options, the chosen one was rehabilitation with a RPD supported by the molars (16 and 17; 26 and 27) and two implants in the 13 and 23 regions. Finally, o-ring components were installed on the implants and captured. Rehabilitation resulted in a RPD with favorable retention, stability, and esthetics. It is concluded that this treatment option contributed to the resolution of a clinical challenge derived from the difficulties associated with a long edentulous space in the anterior region and provided the patient with an aesthetic and functional denture.

Keywords: Biomechanic. Denture, Partial, Removable. Dental Implants.

Resumo

Próteses parciais removíveis (PPR) são uma indicação para planejamento de Classe IV de Kennedy. Porém, em espaços edêntulos amplos, torna-se um desafio biomecânico, pois resulta em uma extremidade livre anterior e, por sua vez, em movimentos de alavanca. Tais condições podem criar maior probabilidade de perda óssea, torque nos dentes pilares e instabilidade da prótese. Nesse sentido, estratégias para melhorar o desempenho biomecânico dos PPRs são essenciais no planejamento. O objetivo deste caso clínico é relatar a reabilitação protética de um paciente parcialmente desdentado, classificação IV Kennedy, com PPR implanto-assistida. A paciente apresentou queixa de instabilidade do PPR na arcada superior e, dentre as opções de plano de tratamento, o escolhido foi a reabilitação com PPR apoiada nos molares (16 e 17; 26 e 27) e dois implantes nas regiões 13 e 23. Finalmente, os componentes do o-ring foram instalados nos implantes e capturados. A reabilitação resultou em um PPR com retenção, estabilidade e estética favoráveis. Conclui-se que esta opção de tratamento contribuiu para a resolução de um desafio clínico derivado das dificuldades associadas a um amplo espaço edêntulo na região anterior e proporcionou ao paciente uma prótese estética e funcional.

Palavras-chave: Biomecânica. Prótese Parcial Removível. Implante Dentário.

1 Introduction

Partial edentulism is associated by clinical challenges and lifestyle impairment.¹ Clinically, it can result in displacement and inclination of adjacent teeth, supra-eruption of opposing teeth, altered speech, changes in facial appearance and temperamental-mandibular disorders^{2,3}. Continuous loss and degradation of alveolar bone, teeth and supporting structures also occur⁴.

A treatment option for partially edentulous patients, especially when the prosthetic space is long, are removable partial dentures (RPDs), which are versatile, reversible, and economical⁵. Biomechanically, the transmission of the masticatory force of these dentures to the alveolar bone can occur only through the abutment teeth (dentosupported) or also with the participation of the mucosa of the residual ridge

(dentomucosupported), the supported free end prostheses⁶.

Masticatory forces applied in the free end region result in a lever movement around the right abutment teeth. This condition is classically known in Kennedy Class I and II cases. However, the long Class IV Kennedy behaves like an “anterior free end”. Lever movement results in traumatizing compressive forces on the denture bearing mucosa and underlying bone, which can generate painful symptoms, torque on the abutment teeth, non-physiological bone resorption with consequent misalignment of the acrylic base to the mucosa and instability of the prosthesis⁷⁻⁹.

Although these forces cannot be totally eliminated in RPDs, biomechanical maneuvers in prosthetic planning are fundamental to improve treatment prognosis.⁸ An alternative that has been recommended is the association of osseointegrated implants with free end RPDs, as they provide

better retention, stability, comfort and patient satisfaction, confidence, reduction of prosthesis movement under the support line, less need for relining and risk combination syndrome¹⁰. Therefore, the aim of this article is to report and discuss oral rehabilitation with implant-assisted removable partial denture in long Class IV Kennedy, as a biomechanical strategy for better treatment prognosis.

2 Case Report

A 46-year-old female patient came forward complaining that the RPD she was using on her maxilla was unstable, which caused her discomfort in speaking, chewing and social insecurity. In the anamnesis and medical history, the patient did not report any systemic problem, however, in the clinical examination, only elements 16, 17, 26 and 27 were observed in the upper arch, with the history of periodontal disease being the reason for the loss of numerous teeth. Elements 35 to 46 were present in the mandibular arch (Figure 1). After clinical and radiographic examination, treatment plans were outlined, and the patient chose rehabilitation with a RPD supported by molars and two implants in the region of 13 and 23, for financial reasons and her preference for removable dentures.

This study was approved by the Bauru School of Dentistry Ethics Committee under approval number 6,660,646.

Figure 1 - Mandibular arch



Source: the authors.

Two implants 4.0x15mm (TitamaxTi EX HE 4.1; Neodent®, Curitiba, Paraná, Brazil) were installed in the right and left upper canine regions with 60N of torque, which were connected to a sphere accessory (Attachment Equator 3mm, 102.121, Neodent®, Curitiba, Paraná, Brazil) (Figure 2). A study model was obtained, in which the outliner planning was carried out. Thus, a circumferential twinned clamp design with appropriate occlusal preparations was used on elements 16 and 17, 26 and 27, and the RPD was conventionally fabricated (Figure 3).

Figure 2 - Two implants and their attachments installed at a long class IV Kennedy in upper arch



Source: the authors

Figure 3 - RPD conventionally fabricated with circumferential twinned clamp design



Source: the authors

Subsequently, o-ring components with cylinder (O-rings 102.107, Neodent®, Curitiba, Paraná, Brazil) were installed on the implants and captured in the mouth with the aid of straight positioners and protection disks (Figure 4).

Figure 4 - Bottom side of implant-assisted RPD with the retentive matrix



Source: the authors

Figure 5 - Maxillary and mandibular arch at occlusion showing the final rehabilitation with implant-assisted RPD in long Class IV Kennedy



Source: the authors.

The final restoration resulted in a RPD stable and retentive supported by teeth and implants (Figure 5).

2.1 Discussion

The present case reported the benefits of implant-assisted removable partial denture, as biomechanical and aesthetics strategies in long Class IV Kennedy.

Epidemiological studies indicate a diminishing prevalence of total edentulism, suggesting a prospective decline due to improved accessibility to oral health services. Concurrently, there is a growing population of partially edentulous individuals eligible for RPD treatment¹¹⁻¹², which is considered a prosthetic challenge, particularly in cases of long edentulous spaces as observed in Kennedy Classes I, II, and IV¹³.

Some strategies have been proposed to enhance biomechanics of RPDs in anterior or posterior free-end edentulous areas, such as use of T-bar retainer and occlusal rest away from the prosthetic space^{6,7}. Functional impression of the free-end is commonly recommended to ensure optimal support for the RPD bases¹⁴⁻¹⁵. The rehabilitation of Kennedy Class IV patients not only involves biomechanical complexities but also requires aesthetics considerations. Consequently, the literature suggests approaches such as utilizing clasps made from flexible materials⁸, custom attachments¹⁶, and crown-retained removable dentures¹⁷.

The association of osseointegrated implants with RPDs in free-ends has substantially improved the prospects of success in oral rehabilitation. The main objective of associating implants with distal extension RPDs is to stabilize the denture vertically, prevent bone resorption under the denture base, promote additional retention, reduce stress on supporting teeth, improve masticatory function, and enhance patient comfort and satisfaction^{10,18-20}. A successful rehabilitation case of a Kennedy Class I patient involved bilateral implants, a RPD, and crowns featuring a modified channel-shoulder-pin system²¹. Two years post-rehabilitation, there was no need for further prosthodontic maintenance, except for the simple activation of matrices of the mandibular RPD to re-establish retention on the abutments²¹.

A retrospective study evaluated the clinical outcomes of posterior implants with surveyed crowns in implant-assisted RPDs over an average period of 60.9 ± 40.2 months²³. The results revealed a 96.9% implant survival rate and 90.6% success rates²³. Implants in crowns-implant-assisted RPDs (Kennedy Class I or II) exhibited a 100% survival rate for periods up to 74 months, with marginal bone loss less than 1.5 mm for 85.7% of implants, remaining successful throughout the follow-up period²³.

For extensive anterior teeth loss, implants associated with o-ring abutments are recommended to provide retention, stability, and aesthetics to RPDs. This approach eliminates the need for clasps on vestibular surfaces of anterior teeth²⁴.

Despite limited documentation, implant-retained dentures are considered an alternative option for long Kennedy Class IV treatment²⁵. A case report documented the successful rehabilitation of a patient with traumatic tooth loss, using osseointegrated implants connected to o-ring-type abutments. After 12 months of follow-up, the patient did not have any functional challenges. The authors concluded that employing osseointegrated implants could be a beneficial approach for patients with traumatic tooth loss or associated malformations, enhancing the support and stability of dentures²⁴.

A recent systematic review demonstrated implant survival rates ranging from 91% to 100%, low rates of technical or prosthetic complications, and increased patient satisfaction compared to that before treatment, regardless of Kennedy's classification²⁶. While the literature strongly supports RPDs associated with implants for posterior free ends (Class I or II)^{21-23,26-27}, there is limited discussion on cases of long Class IV, which biomechanically behave similarly to anterior free ends. This article described the prosthetic rehabilitation of a partially edentulous Class IV Kennedy patient, using a RPD involving teeth and implants to address challenges associated with a large anterior edentulous space, achieving both aesthetic and functional rehabilitation. These factors served as foundational elements of RPD, providing additional retention and stability. Randomized clinical trials are required to provide a higher level of evidence-based literature than clinical reports for implant-assisted RPD in long Class IV cases.

3 Conclusion

Implant-assisted RPD in long Class IV Kennedy cases proved to be an effective and feasible treatment option in the presented clinical case, addressing issues of RPD retention, stability, and patient satisfaction with oral rehabilitation.

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